

Specification

PROJECT FILE NO. 021052

Backhoe Modifications – Lock Check Valves for the OU 7-10 Glovebox Excavator Method Project

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho



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Rev. 03

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ACRONYMS

AISC	American Institute of Steel Construction
ASTM	American Society of Testing and Materials
BES	Backhoe Excavation System
CAT	Caterpillar Incorporated
INEEL	Idaho National Engineering and Environmental Laboratory
OSHA	Occupational Safety and Health Administration
OU	Operational Unit
PGS	Packaging Glovebox System
RCS	Retrieval Confinement Structure
SAE	Society of Automotive Engineers
WES	Weather Enclosure Structure

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1. SUMMARY

1.1 General

The Idaho National Engineering and Environmental Laboratory (INEEL) will procure a Backhoe Excavation System (BES). The BES incorporates a modified Caterpillar (CAT) 446B backhoe loader and associated end effectors. The backhoe loader will be the primary instrument used in the retrieval of radioactively contaminated waste in the Operable Unit (OU) 7-10 Glovebox Excavator Method Project.

The Glovebox Excavator Method Project incorporates the Retrieval Confinement Structure (RCS) located over the excavation site. The RCS consists of a steel-framed, steel-paneled structure with Lexan windows. The confinement structure is located within a larger fabric-skinned Weather Enclosure Structure (WES). Packaging Glovebox Systems (PGS) are attached directly to the confinement structure and are fed by track guided transfer carts protruding over the excavation area.

A standard 446B backhoe performs soil excavation, probe removal, 55-gallon drum removal (using a jaw bucket design), and core sampling (using a jackhammer/core sampler design). The backhoe cab and loader are located outside the RCS, while the boom, stick, and various end effectors are located inside the contaminated RCS structure (see Figure 1 and Figure 2).

Freezing the boom and stick position during hydraulic line rupture or during an emergency situation is highly desirable. Hydraulic line rupture on the backhoe boom and stick are of paramount concern. If the boom or stick hydraulic lines were to rupture during waste excavation the damage inflicted on a transfer cart frame by a falling boom would be unacceptable (see Figure 2). Additionally, the operator must stop the backhoe engine during an emergency situation. Stopping the engine disengages the hydraulic pump and prevents the boom from swinging left, right, and vertically upward. Disengaging the hydraulic pump does not prevent the boom (or stick) from dropping. Damage from a falling boom or stick can be mitigated by installing lock check valves on the boom within close proximity to the pivot point and as shown in contract drawings 519931 and Figure 2.

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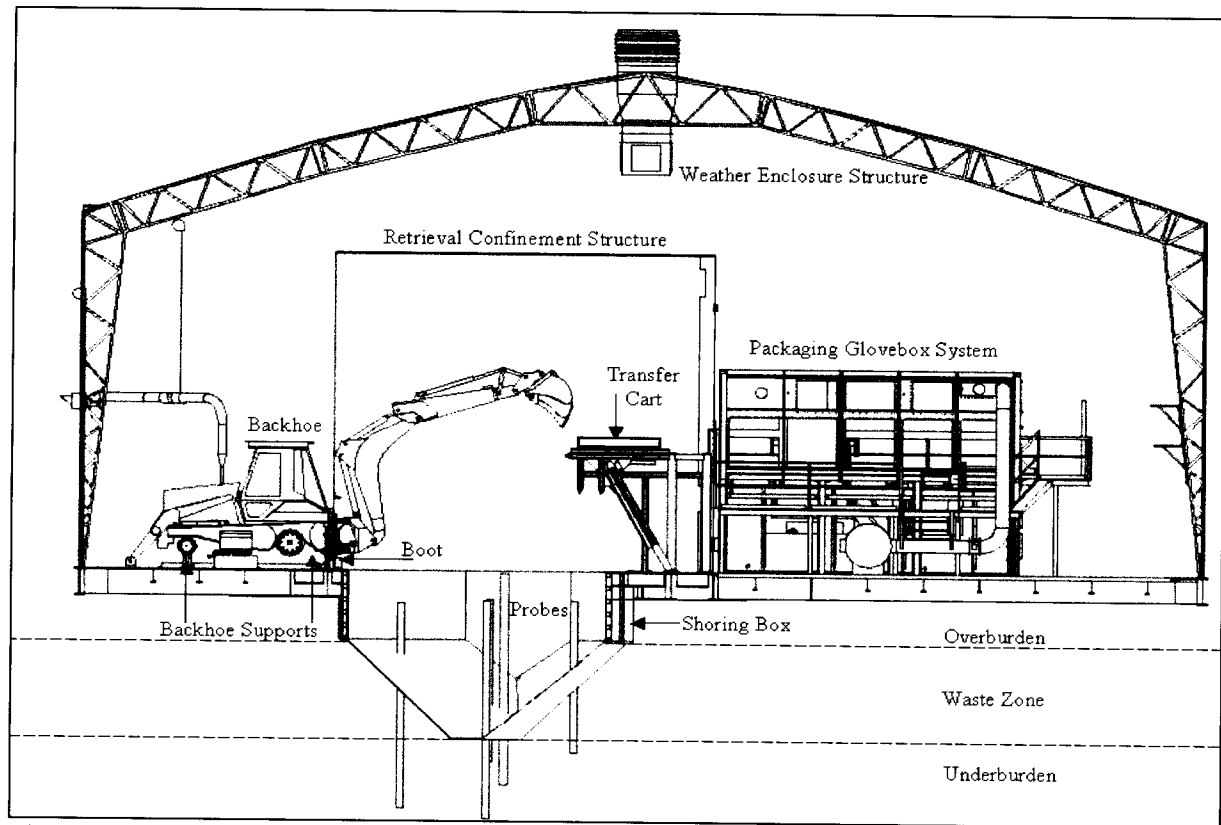


Figure 1. Cross section of the Glovebox Excavator Method Project facility.

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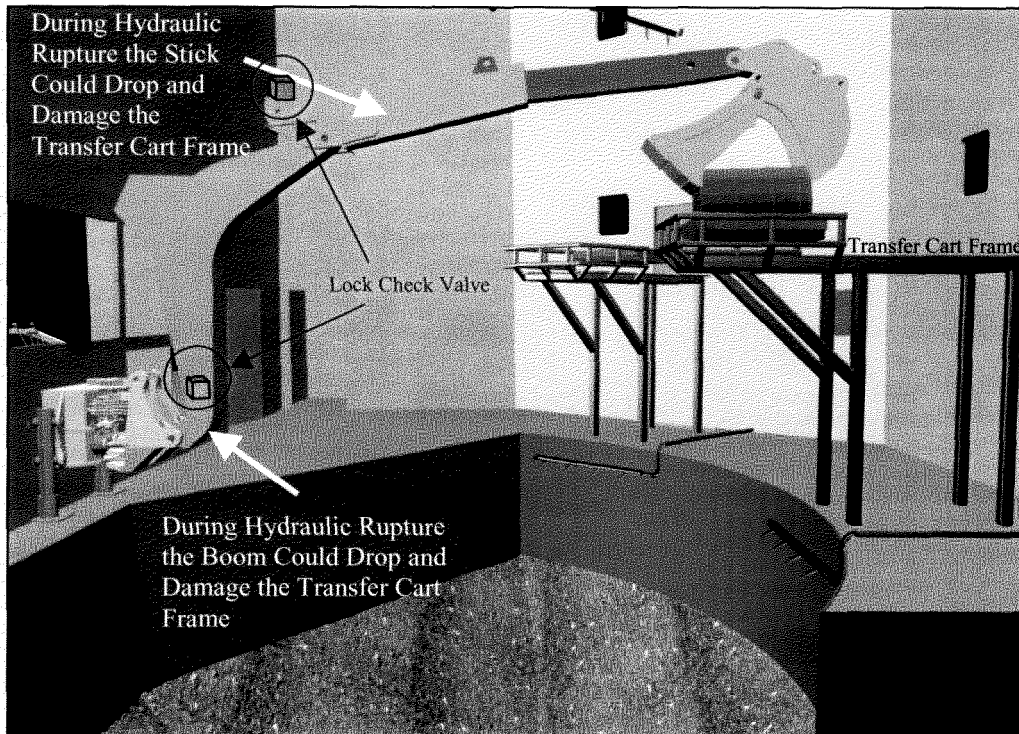


Figure 2. Location of lock check valves.

While it is imperative to prevent the boom and stick from falling during hydraulic rupture, it is equally as imperative to prevent the bucket from inadvertently falling due to the combined weight of the bucket and coupler. To prevent the weight of the combined jaw bucket/coupler from pushing the return hydraulic fluid (from the bucket curl cylinder) back to the tank faster than the pump can supply fluid to the bucket curl cylinder, lock check valves shall be installed onto the stick within close proximity to the stick/boom joint as shown in contract drawing 519931 and Figure 2. Adjusting the throughput on a locking check valve controls the bucket curl cylinder.

Figure 3 presents a cross sectional view of the desired check valve. During loss of oil pressure, the oil in lines 8 and 10 is stopped and the rod in the cylinder cannot move. The springs in lines 6 and 7 and the oil in lines 8 and 10 keep the balls on the seats in line 9. The oil in lines 1 and 3 are either at tank pressure (emergency stop) or atmospheric pressure (line rupture).

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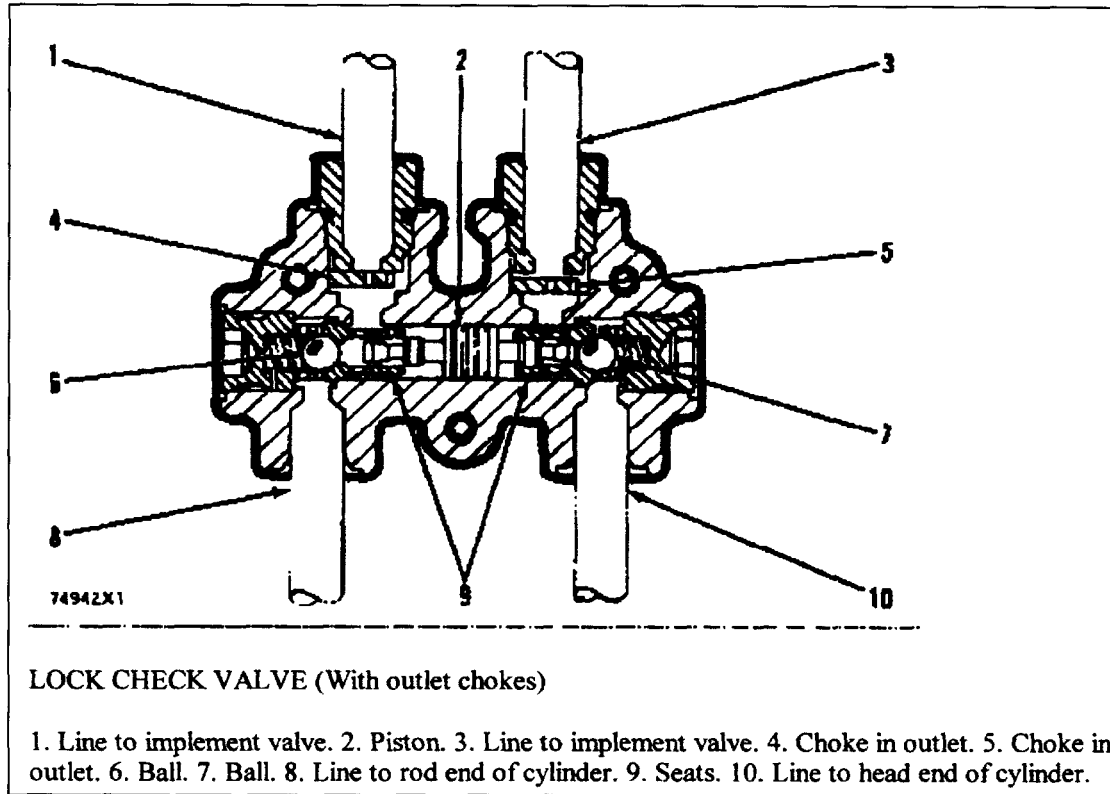


Figure 3. Lock check valve.

Loss of oil pressure occurs when the engine is turned off, the supply hydraulic line ruptures between the valve body and the check valve, and/or the return hydraulic line ruptures between the check valve and the valve body.

1.2 Work Included

This specification covers the subcontractor and equipment supplier's requirements for the design, fabrication, assembly, installation, and testing of the lock check valves. It is not the intent of this Specification to completely define all details of installation. Equipment shall be designed, fabricated, assembled, and installed in accordance with this specification and the equipment supplier and subcontractor's standard practices when such practices do not conflict with this specification.

The lock check valve systems and all associated hardware shall be completely assembled and installed into the 446B backhoe at the subcontractor's facility.

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The following shall be delivered to Bechtel BWXT Idaho, LLC:

- A complete and fully integrated system of the lock check valve on a 446B backhoe boom cylinder as shown on contract drawing 519931.
- A complete and fully integrated system of the lock check valve on a 446B backhoe stick cylinder as shown on contract drawing 519931.
- A complete and fully integrated system of the lock check valve on a 446B backhoe bucket curl cylinder as shown on contract drawing 519931.
- Vendor data submittals in accordance with the vendor data schedule and this specification.

1.3 Work Not Included

None identified.

1.4 INEEL—Furnished Materials, Equipment, and Services

The INEEL will furnish the 446B backhoe loader.

2. APPLICABLE CODES, PROCEDURES, AND REFERENCES

The following documents form a part of this specification to the extent specified herein and as applicable. Unless otherwise specified, the issue in effect on the date of invitation to bid shall apply. In case of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

2.1 National and Local Codes

Occupational Safety and Health Administration (OSHA)

OSHA 29 CFR 1910, Occupational Safety and Health Standards

2.2 Industry Standards and DOE Orders

American Institute of Steel Construction (AISC)

AISC, Manual of Steel Construction

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American Society of Testing and Materials (ASTM)

ASTM A36, Structural Steel

ASTM A570, Standard Specification for Structural Steel, Sheet and Strip,
Carbon, Hot-Rolled

ASTM A325, Standard Specification for Structural Bolts, Steel, Heat-
Treated 120/105 ksi Minimum Tensile Strength

Society of Automotive Engineers (SAE)

SAE J31, Hydraulic Backhoe Lift Capacity

SAE J109, Hydraulic Excavator Lift Capacity Calculation and Test
Procedure

2.3 Military (National) Specification

Not applicable.

2.4 Related Specifications

Not applicable.

2.5 References

Not applicable.

3. TECHNICAL REQUIREMENTS

3.1 General

The lock check valve device shall be designed by the equipment supplier to provide for a fully functional system and to perform as specified in a safe and efficient manner. This section defines the design requirements for the lock check valve device.

Hydraulic pressure: 2,900–3,500 lb

Hydraulic Flow: 25–30 gpm

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3.2 Restrictions

None identified.

3.3 Performance Requirements

The locking check valve shall be capable of stopping the boom and/or stick descent during loss of hydraulic pressure in the supply line, return line or both lines simultaneously.

The locking check valve shall be capable of stopping the boom and/or stick descent during backhoe engine shutdown or failure.

The locking check valve shall be capable of preventing the jaw bucket from inadvertently curling during a controlled manipulation of the bucket.

3.4 Software

Not applicable.

3.5 Registered Professional Engineer Certification

Not applicable.

3.6 Human Factors

Not applicable.

3.7 Reliability and Maintainability

3.7.1 Reliability

All subcomponents of the lock check valve device shall be of a quality that the expected mean time between failure for this system shall not be less than 1,080 hours.

The lock check valve bearings, fittings, and controls shall be sealed against moisture and damaging particle intrusion using standard industrial components, as practical.

The lock check valve systems shall employ rugged, industrial off-the-shelf equipment to the maximum extent practical.

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3.7.2 Maintainability

The lock check valve device standard replacement parts, shown on manufacturer's recommendations, shall be readily available for routine maintenance activities.

3.8 Environmental Regulatory Requirements and/or Site and Operating Requirements

Not applicable.

3.9 Natural Phenomena Requirements

Not applicable.

4. ENVIRONMENTAL, SAFETY, AND HEALTH REQUIREMENTS

4.1 Subcontractor Safety

The subcontractor shall work in accordance with applicable OSHA requirements as stated in 29 CFR 1910.

4.2 Personal Protective Equipment

The subcontractor shall determine and require use of appropriate personal protective equipment for all tasks performed.

4.3 Emergency Response

Not applicable.

4.4 Accident Investigation

Not applicable.

5. MANUFACTURING AND ASSEMBLY

5.1 General

The lock check valves shall be installed onto a 446B backhoe, in the subcontractor's shop, to ensure proper fitting and operation. The contractor's technical representative or alternate will inspect the assembled final product. Assembly of the equipment shall be made in a clean, dust-free area of the subcontractor's facility.

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5.2 Prohibitions

None identified.

5.3 Material

Materials used shall be free from defects that would adversely affect the performance or maintainability of individual components or the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in the equipment manufacturer's standard commercial practice. Materials shall be as delineated on contract drawings.

5.4 Fabrication

Not applicable.

5.5 Equipment Tagging

Not applicable.

5.6 Cleaning, Painting, and Coating

All mounting equipment shall be thoroughly cleaned. All scale, oxides, lubricants, chips, and other foreign matter shall be removed. All burrs, castings, scars, and sharp edges shall be ground smooth.

5.7 Spare Parts

Applicable standard quality requirements identified in the procurement package shall be cross-referenced.

5.8 Other Processes

Not applicable.

6. SUBMITTALS

As a minimum, the subcontractor shall provide the contractor with the submittals referenced in this section. The subcontractor shall be responsible for all submittals that come from the equipment supplier. Additional submittal requirements are defined in the vendor data schedule and applicable contract documents. The quantities and submittal schedule is included in the attached vendor data schedule.

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6.1 General Submittal Requirements

6.1.1 General Procedures

Vendor data, whether prepared by the subcontractor or subcontractor's subtier, or supplier, shall be submitted as instruments of the subcontractor. Therefore, prior to submittal, the subcontractor shall ascertain that material and equipment covered by the submittal and the contents of the submittal itself meet all the requirements of the subcontract specifications, drawings, and other contract documents.

Each submittal shall contain identification for each separable and separate piece of material or equipment and literature with respect to the information provided in the specification and on the vendor data schedule. Each submittal shall be numbered consecutively.

6.1.2 Vendor Data Schedule

Vendor data required by the specification sections are identified on the vendor data schedule. The vendor data schedule provides a tabular listing by item number, drawing, or specification reference and a description of the item or service. The type of submittal is identified by a "Vendor Data" code, and the time required to submit the item is identified by a "When to Submit" code. An "Approval" code specifies whether the submittal is for mandatory approval or for information only. One copy of routine paper or electronic file submittals is required; additional copies may be required by the vendor data schedule. Electronic file submittals are preferred.

6.1.3 Vendor Data Transmittal and Disposition Form 431.13

All vendor data shall be submitted to the contractor using the Vendor Data Transmittal and Disposition Form. The form provides the subcontractor a method to submit vendor data and provides the contractor a means of dispositioning the submittal. The subcontractor shall list the vendor data schedule item number, a vendor data transmittal tracking number (if applicable), the drawing or specification number reference, a tag number (if applicable), the submittal status (e.g., mandatory approval, information only, or re-submittal), the revision level, and the item description. The description should be complete enough that a person unfamiliar with the project can determine what the submittal includes.

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6.1.4 Disposition by the Contractor

The contractor's comments and required action by the subcontractor will be indicated by a disposition code on the submittal. The disposition codes will be classed as follows:

- A. **Work May Proceed:** Submittals so noted will generally be classed as data that appears to be satisfactory without corrections.
- B. **Work May Proceed with Comments Incorporated. Revise Affected Sections and Resubmit Entire Submittal:** This category will cover data that, with the correction of comments noted or marked on the submittal, appear to be satisfactory and require no further review by the contractor prior to construction.
- C. **Work May NOT Proceed. Revise and Resubmit:** Submittals so dispositioned will require a corrected re-submittal for one of the following reasons:
 - (1) Submittal requires corrections, shown on comments, prior to a final review.
 - (2) Submittal data is incomplete and requires more detailed information prior to a final review.
 - (3) Submittal data does not meet subcontract document requirements.
- D. **Accepted for Use. Information Only Submittal:** Submittals so dispositioned will generally be classified as information only for as-specified material and equipment.

Mandatory approval-coded vendor data will be reviewed by the contractor and receive an A, B, or C disposition. Information only submittals without comments will receive a D disposition. The A, B, and C-coded dispositioned submittals will be returned to the subcontractor. The D-dispositioned submittals will not be returned to the subcontractor. The contractor may provide internal review of information only submittals. In the event that comments are generated on an information only submittal, the submittal may be dispositioned B or C and returned to the subcontractor for appropriate action. Acknowledgment of receipt of dispositioned vendor data by the subcontractor will not be required.

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The contractor will return dispositioned submittals with reasonable promptness. The subcontractor shall note that a prompt review is dependent on timely and complete submittals in strict accordance with these instructions.

6.2 Spare Parts and Special Tools List

The subcontractor shall submit to the contractor a list of recommended spare parts and any special tools required for operation and maintenance of the lock check valve system. This list shall include all corresponding suppliers of each component and their phone numbers.

6.3 Operations and Maintenance Manuals

The operations and maintenance manual shall cover the installation, operation, and maintenance of the equipment in detail. All drawings, diagrams, and record forms required for the installation shall be included and incorporated in the manual.

6.4 Drawings

The equipment supplier shall submit prints of the final drawings disclosing the configuration of the lock check valve devices. These drawings shall document the mechanical and hydraulic configuration. The drawings shall be of sufficient detail to allow the contractor to identify and evaluate the systems and components for installation, operation, maintenance, and repair activities without detailed physical inspection of the actual hardware.

6.5 Software

Not applicable.

6.6 Inspection Test Plans, Procedures, and Reports

Inspection of these documents includes the following:

- Performance test procedures (subcontractor preshipment): Performance test plans and procedures as outlined in section 7.4.1 of this specification.
- Performance test reports (subcontractor preshipment): Performance test results and reports as outlined in section 7.4.2 of this specification.

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7. QUALITY ASSURANCE

7.1 Minimum Qualifications of Manufacturer, Supplier, or Personnel

The equipment shall be assembled and installed by a firm that has prior related experience pertaining to the installation of a lock check valve on a hydraulic system.

7.2 QA Program

The manufacturer is responsible for providing materials and workmanship that meets the codes and standards identified in this specification.

7.3 Nondestructive Examination

Not applicable.

7.4 Operational Testing

7.4.1 Performance Test Procedures (Subcontractor Preshipment)

The equipment supplier or subcontractor shall submit to the contractor an “in-shop” testing plan and procedure prior to the demonstration of both locking check-valve capabilities. The plan and procedure shall include the date, test conditions, duration of testing, testing sequence, materials used, and methods of performing the tests.

The subcontractor shall inform the contractor one week in advance of performance testing so a contractor representative may be present during the testing process.

Subcontractor testing should demonstrate that all equipment operates and interfaces together into a functional automated check valve system as defined within this specification.

Testing acceptance includes the following criteria:

- Test the lock check valve’s capability at stopping the boom descent during a loss of supply fluid through manipulation of the appropriate valve, followed by engine shut down.
- Test the lock check valve’s capability at stopping the stick descent during a loss of supply fluid through manipulation of the appropriate valve, followed by engine shut down.

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- Test the lock check valve's capability at stopping both the stick and the boom descent during backhoe engine failure through engine shut down, followed by valve manipulation.
- Test the lock check valve's capability at preventing inadvertent bucket movement during a controlled bucket manipulation (curl and uncurl).

7.4.2 Performance Test Report (Subcontractor Preshipment)

The equipment supplier or subcontractor shall submit to the contractor the "in-shop" testing results following demonstration of the locking check valve at the equipment supplier's or subcontractor's facility.

7.5 Special Processes

Not applicable.

8. PACKAGING AND SHIPPING

8.1 Packing and Packaging

Not applicable.

8.2 Marking and Handling

Not applicable.

8.3 Special Transportation Requirements

Not applicable.

9. INSTALLATION AND MAINTENANCE

9.1 Installation

The lock check devices shall be installed onto the 446B backhoe, used for the Operational Unit (OU) 7-10 Glovebox Excavator Method Project, at the subcontractor's facility.

INEEL personnel will install the backhoe and all associated equipment (including attached lock check valve system) into the RCS structure.

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9.2 Startup and Calibration

Not applicable.

9.3 Training

Not applicable.

9.4 Maintenance

Not applicable.

10. MARKING AND IDENTIFICATION

Not applicable.

11. ACCEPTANCE

11.1 Final Acceptance Method

Successful performance of the test results and submittal of all documents listed on the vendor data schedule will constitute acceptance.

11.2 Inspection and Hold Points

Unless otherwise specified by the purchase order, the supplier shall notify the contractor at least five working days in advance of the time that the lock check valves will be available for source inspection by the contractor representative. Work cannot proceed without written authorization from the contractor after hold point inspection.

11.3 INEEL Surveillance and Audits

The authorized contractor representative may perform source inspection or surveillance.

12. ATTACHMENTS

Vendor data schedule- Form 431.14

Contractor drawing 519931

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ATTACHMENT A

431.14
08/01/2001
Rev. 03

Vendor Data Schedule

Project Title OU 7-10 GLOVEBOX EXCAVATOR METHOD PROJECT - BACKHOE
MODIFICATION - LOCK CHECK VALVES **Project No.** 021052 -
22005

System Engineer/Project Manager LOPEZ DARYL A **Date:** 12-APR-02 **Rev:** 0

Vendor Data Coordinator Address STURM BETH L, WCB-3WH502, MS: 3535

Vendor Data Codes				
A. As-Built Drawings B. Assembly Drawings C. Attendance Record D. Blasting Plan E. Catalog Data F. Chem & Physical Analysis G. Concrete Mix Design H. Control System Diagram I. Design Calculations J. Installation Instructions	K. Manufacturers Data Report L. O&M Manual M. Parts List N. Piping Drawing O. Procedure/Instructions P. Pump Head Curves Q. Personnel Qualifications R. Red_line Drawings S. RSMI & Maintenance Log T. Sample(Color, Texture, etc.)	U. Shop Drawings V. Survey Records W. Test Procedure X. Special Processes Y. Operational/CC Testing Z. Test Reports AA. UL/FM Listing AB. Warranty/Guarantee AC. Weld Records AD. Wiring Diagrams	AE. MSDS AF. Hardware Schedule AG. Specification AH. Manufacturing/Inspection/Test Plan AI. Test Certification AJ. Recommended Spares AK. Special Tools List AL. Certificate of Conformance AM. Certificate of Disposal or Destruction AN. Design Verification	AO. Design Qualification Testing AP. Traceability Procedure AQ. Cleaning Procedure AR. Weld Procedure Qualification AS. Welder Performance Personnel Qualifications AT. Non-Destructive Examination Personnel Certifications AU. Inspector Certifications AV. Limited Shelf Life/Operational Data AW. Special Packaging, Shipping, and Rigging Procedure AX. Certificate of Materials to ASME Code AY. Chemical Inventory AZ. Other
When to Submit				
AC - As Completed AT - After Test BC - Before Contract Awarded	BFA - Before Final Acceptance BFR - Before Fabrication Release ROS - Removed Off-Site PDS - Prior to Delivery on site	PTP - Prior to Purchase PS - Prior to Shipment PT - Prior to Test	PTC - Prior to Construction Start PTI - Prior to Installation PTW - Prior to Welding	TS - Time of Shipment WP - With Proposal

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ATTACHMENT A

Item No.	Clause/Article or Drawing/Specification Reference	Description	Vendor Data Code	Extra Copies Required	When to Submit	Approval Code
	7.4.1		W. Test Procedure	4	PT - Prior to Test	Approval Required
	7.4.2		Z. Test Reports	4	AT - After Test	Approval Required
	6.2		AK. Special Tools List	4	PS - Prior to Shipment	Information Only
	6.3		L. O&M Manual	4	PS - Prior to Shipment	Information Only
	6.4		B. Assembly Drawings	4	BFR - Before Fabrication Release	Approval Required
	6.2		AJ. Recommended Spares	4	PS - Prior to Shipment	Information Only

Instructions: 1. Refer to subcontract documents for instructions on submittals.
2. Electronic submittals in lieu of paper documents are acceptable and encouraged.
3. The normal number of copies required is ONE. If more are required, the number will be shown here.
4. THE INEEL WILL SCAN ALL SUBMITTED VENDOR DATA INTO A SYSTEM THAT IS ACCESSIBLE TO ALL INEEL EMPLOYEES UNLESS THE SUPPLIER/SUBCONTRACTOR IDENTIFIES SUBMITTED INFORMATION AS PROPRIETARY.